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10/525,359	11/03/2005	Johannes Konle	3926.136	3927

7590 06/10/2009  
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EXAMINER
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FORREST, MICHAEL

ART UNIT	PAPER NUMBER
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1793

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06/10/2009

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/525,359	<b>Applicant(s)</b> KONLE ET AL.	
	<b>Examiner</b> MICHAEL FORREST	<b>Art Unit</b> 1793	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 3/20/2009.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 18-35 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 18-35 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)          | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____                                      |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)          | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____  | 6) <input type="checkbox"/> Other: _____                          |

## **DETAILED ACTION**

### ***Specification***

The amendment filed 3/10/2009 is objected to under 35 U.S.C. 132(a) because it introduces new matter into the disclosure. 35 U.S.C. 132(a) states that no amendment shall introduce new matter into the disclosure of the invention. The added material which is not supported by the original disclosure is as follows:

Appendix: Figures 1a, 1b, and Figure 2 introduces new matter to the application and has not been entered to the Specification. There is no support in the application as previously filed and entered that provides supports for the embodiments disclosed in the Appendix.

Applicant is required to cancel the new matter in the reply to this Office Action.

The amendment filed 3/10/2009 is also objected to because of the following informalities: Appendix: Figures 1a, 1b, and Figure 2 are graphical illustrations.

Graphical illustrations, diagrammatic views, flowcharts, and diagrams in the descriptive portion of the specification do not come within the purview of 37 CFR 1.58(a), which permits tables, chemical and mathematical formulas in the specification in lieu of formal drawings. The specification, including any claims, may contain chemical formulas and mathematical equations, but the written description portion of the specification must not contain drawings or flow diagrams. See MPEP 601.IV.

***Claim Rejections - 35 USC § 112***

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claim 21 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

The specification of the original application does not support the introduction of the limitation where the catalyst body where "one of the outside faces of the body which is perpendicular to the cavities carries a metallic coating with a high hydrogen permeability."

Claim 25 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

The step of "depositing a thin metallic layer (typical thickness is around 1 micron) on one side of the catalyst body which has a high hydrogen permeability" is new matter.

The step of "combining two of the so processed reactor units and aligning them oppositely to each other in such a way that an "interdigit" structure is formed. By this structure a meander channel is formed which considerably enhances the reaction volume" is new matter.

Although these claims are rejected on the basis of introduction of new matter, for purposes of examination, the limitations which do not find support in the original specification have still been considered based on prior art rejections.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 25 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 25 recites the limitation "so processed reactor units" in Line 11. There is insufficient antecedent basis for this limitation in the claim.

### ***Claim Objections***

Claim 19 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Reciting that the layer elements "advantageously consist of" in the broadest reasonable interpretation is

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merely a recitation of a preference and does not further limit Claim 18. A recommended amendment would be for the layer elements to "consist of silicon or silicon compound alloy."

Claim 28 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Claiming a method that includes additional alignment marks provided on the layer elements is a repetition of a limitation already claimed in Claim 25 upon which the claim depends.

Claim 31 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Claiming a method that includes supplying a catalytic active material at the inner walls of the etched cavities is a repetition of a limitation already claimed in Claim 25 upon which the claim depends.

Claim 33 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Claim 33 claims dependence on itself. For purposes of examination, the examiner has assumed that the intention of applicant was for Claim 33 to depend on Claim 32.

***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claim 18-20 22, 24, 32 are rejected under 35 U.S.C. 102(b) as being anticipated by Lehmann(WO 99/061147) (referred to herein as the US equivalent patent Lehmann(US Patent 6,887,437)).

Lehmann teaches a reactor comprising a housing and a porous silicon substrate that is used as a catalyst support. The silicon substrate comprises a first and second main surface and holes extending perpendicularly and traversing from the first main surface to the second main surface (see Col 1, lines 40-53). Lehmann further teaches a reactor where platinum is a suitable catalytic layer (see Col 2, Lines 41-42).

Where a single prior art reference teaches all of the limitations of a claim the claim is anticipated and unpatentable. Here, Lehmann teaches a porous silicon substrate(catalyst body) and a reactor housing(in a hydrogen reforming reactor), where the silicon substrate comprises a first and second main surface and holes extending perpendicularly and traversing the surfaces(one or more layer elements through which streamable media can flow and extend perpendicularly to the surface).

A recitation of the intended use of the claimed invention must result in a structural difference between the claimed invention and the prior art in order to

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patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim. Here, the instant claim contains the phrase "hydrogen reforming reactor" in the preamble. It is only a statement of intended use without disclosing any structural difference with the reactor taught by Lehmann. The reactor taught by Lehmann is capable of performing the intended use since Platinum is a suitable catalyst for hydrogen reforming.

Regarding Claim 19, Lehmann further teaches that the substrate comprises silicon as the substrate material (see column 1, lines 40-53).

Regarding Claim 20, Lehmann further teaches a substrate comprising holes with variable dimensions from the exterior and interior (see column 2, Line 63 to Col 3, Line 4 and Figure 5).

Regarding Claim 22, Lehmann further teaches that the inner surface features of the substrate can be coated with metal catalysts (see column 2, lines 41-42).

Regarding Claim 24, Lehmann further teaches that the substrate is n-doped silicon which is electrically conductive (see column 4, lines 42-45).

Regarding Claim 32, Lehmann teaches a reactor comprising a housing and a porous silicon substrate that is used as a catalyst support. The silicon substrate comprises a first and second main surface and holes extending perpendicularly and traversing from the first main surface to the second main surface (see Col 1, lines 40-53). Lehmann teaches that the housing including feeds where reactants which pass via the first feed into the space then pass through the pores to the second feed (see Col 4, Lines 35 to 41 and Figure 1)



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Where a single prior art reference teaches all of the limitations of a claim the claim is anticipated and unpatentable. Here, Lehmann teaches a porous silicon substrate(catalyst body) and a reactor housing(in a hydrogen reforming reactor), where the silicon substrate comprises a first and second main surface and holes extending perpendicularly and traversing the surfaces(one or more layer elements through which streamable media can flow and extend perpendicularly to the surface).

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation

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under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claim 21 is further rejected under 35 U.S.C. 103(a) as being unpatentable over Lehmann (WO 99/061147) (referred to herein as the US equivalent patent Lehmann(US Patent 6,887,437)), as applied to Claim 19, and in further view of Lin et al(US Patent 6,207,132).

As applied to Claim 18, Lehmann teaches a reactor comprising a porous silicon substrate that is used as a catalyst support. The silicon substrate comprises a first and second main surface and holes extending perpendicularly and traversing from the first main surface to the second main surface (see Lehmann US Patent 6,887,437, column 1, lines 40-53).

Lehmann does not teach a reactor where one of the outside faces of the catalyst body which is perpendicular to the cavities carries a metallic coating with a high hydrogen permeability.

Lin teaches a reactor for catalytically converting hydrocarbon to produce very pure hydrogen comprising a catalyst bed which has supported on an interior face a hydrogen-permeable membrane of palladium (see Col 4, Lines 21 to 50 and Figure 1). Lin further teaches that the apparatus produces high purity hydrogen and performs instantaneous separation (see Col 2, Lines 40 to 65). It would have been obvious to one of ordinary skill in the art at the time of the invention to produce the reactor as

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taught by Lehmann with a layer of hydrogen-permeable membrane disposed on the output side as taught by Lin to produce high purity hydrogen and instantaneously separate the hydrogen.

Claim 23 and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lehmann(WO 99/061147) (referred to herein as the US equivalent patent Lehmann(US Patent 6,887,437)), as applied to Claim 18 or 32, and further in view of Ashmead(US Patent 5,534,328).

As applied to Claim 18, Lehmann teaches a reactor comprising a porous silicon substrate that is used as a catalyst support. The silicon substrate comprises a first and second main surface and holes extending perpendicularly and traversing from the first main surface to the second main surface (see Lehmann US Patent 6,887,437, column 1, lines 40-53).

Lehmann does not specifically teach a reactor where the silicon substrates comprise at least two layers having alignment marks.

Ashmead teaches an apparatus for chemical processes that comprises a plurality of laminae with one or more channels on each lamina (see column 2, lines 58 to 64). Ashmead further teaches that silicon wafers can have alignment indicia (see column 15, lines 30-34). Ashmead further teaches that comprising the apparatus with a plurality of laminae allows it to be adapted to effect all or nearly all chemical reactions that one may conceive and one skilled in the art can design an apparatus having requisite size, shape, throughput, and number and geometry of the laminae (see Col 5, Lines 56-65).

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It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the porous-silicon substrate as taught by Lehmann with multiple laminae having alignment marks as taught by Ashmead so that the reactor can be adapted and optimized for the chemical reaction.

Regarding Claim 33,

As applied to Claim 32, Lehmann teaches a reactor comprising a housing and a porous silicon substrate that is used as a catalyst support. The silicon substrate comprises a first and second main surface and holes extending perpendicularly and traversing from the first main surface to the second main surface (see Col 1, lines 40-53). Lehmann teaches that the housing including feeds where reactants which pass via the first feed into the space then pass through the pores to the second feed (see Col 4, Lines 35 to 41 and Figure 1)

Lehmann does not teach a reactor where the reactor is divided into several segments and each segment consisting of the said catalyst body.

Ashmead teaches an apparatus for chemical processes that comprises a plurality of silicon wafer laminae with one or more channels on each lamina (see column 2, lines 58 to 64). Ashmead teaches an apparatus where critical features can be replicated so that larger amounts of chemicals may be processed by simply replicating the features as many times as necessary to achieve the desired production rate(see column 7, line 62 to column 8, line 4). It would have been obvious to one of ordinary skill in the art at the time of the invention to produce the reactor as taught by Lehmann with a replication of the catalyst support as taught by Ashmead to achieve desired production rates.

Claim 25-29, 31, and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lehmann (WO 99/061147) (referred to herein as the US equivalent patent Lehmann(US Patent 6,887,437) in further view of Lin et al(US Patent 6,207,132) and further in view of Ashmead(US Patent 5,534,328).

Lehmann teaches a method of fabrication of a highly perforated workpiece having holes extending perpendicular to a first surface of the workpiece, the method comprising the steps of etching a substrate silicon wafer to produce holes extending through the wafer. Lehmann further teaches depositing a catalytic active material at the inner walls of the etched pores (see Lehmann column 2, lines 34-42).

Lehmann does not specifically teach the steps of:

- (1) depositing a thin metallic layer on one side of the catalyst body which has a high hydrogen permeability.
- (2) stacking of the equally processed wafers using a pre-defined alignment structure.
- (3) combining reactor units and aligning them oppositely to each other in a way that an "interdigit" structure is formed.

Regarding depositing a thin metallic layer on one side of the catalyst body which has a high hydrogen permeability,

Lin teaches a method for making a reactor for catalytically converting hydrocarbon to produce very pure hydrogen comprising a catalyst bed by supporting on an interior face a hydrogen-permeable membrane of palladium (see Col 4, Lines 21 to

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50 and Figure 1). Lin further teaches that the apparatus produces high purity hydrogen and performs instantaneous separation (see Col 2, Lines 40 to 65). It would have been obvious to one of ordinary skill in the art at the time of the invention to produce the reactor as taught by Lehmann with a layer of hydrogen-permeable membrane disposed on the output side as taught by Lin to produce high purity hydrogen and instantaneously separate the hydrogen.

Regarding stacking of the equally processed wafers using a pre-defined alignment structure,

Ashmead teaches the stacking of etched silicon wafers and the bonding of the wafers to produce an integral structure (see Col 3, Line 32 to Col 4, Line 11). Ashmead further teaches that the silicon wafers can have alignment indicia (see column 15, lines 30-34)

Ashmead teaches that comprising the apparatus with a plurality of laminae allows it to be adapted to effect all or nearly all chemical reactions that one may conceive and one skilled in the art can design an apparatus having requisite size, shape, throughput, and number and geometry of the laminae (see Col 5, Lines 56-65). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the porous-silicon substrate as taught by Lehmann with multiple laminae having alignment marks as taught by Ashmead so that the reactor can be adapted and optimized for the chemical reaction.

Regarding combining reactor units and aligning them oppositely to each other in a way that an "interdigit" structure is formed,

Ashmead further teaches an etched structure on laminae that consists of a series of straight segments, alternating with each other, connected together to form a continuous path (see Col 11, Lines 3 to 12). Ashmead further teaches that overall mixer formed by these alternating segments may be described as having a serpentine path (see Col 11, Lines 3 to 12 and Figure 5). The serpentine path appears as an interdigitated structure in Figure 5 and the would produce mixing characteristics during flow. It would have been obvious to one of ordinary skill in the art at the time of the invention to produce the catalyst body as taught by Lehmann where the straight segments of the catalyst body alternate with each other connecting to form a serpentine path as taught by Ashmead to improve mixing of the reagents.

Regarding Claim 26, Lehmann further teaches a method of fabrication where the etching is accomplished by deep anodic etching or photo anodic etching (see column 4, lines 42-54).

Regarding Claim 27, Lehmann further teaches a method of fabrication where the etched surface is pre-patterned by a photo-lithographic process (see column 5, lines 23-28). Ashmead further teaches that the fabrication of the lamina is accomplished by known semiconductor processing techniques for silicon wafers. Ashmead further teaches the fabrication of the lamina by anisotropic etching techniques. At the time the invention of the present application was made, plasma etching was a well known semiconductor processing technique known for etching highly anisotropic features. It would have been obvious to one of ordinary skill in semiconductor processing at the

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time of the invention to fabricate the porous silicon by plasma etching following photolithography.

Regarding Claim 28, Ashmead further teaches the addition of alignment indicia to the silicon wafers to ease the alignment of layers (see column 15, lines 30-34).

Regarding Claim 29, Lehmann further teaches a method of fabrication where the etched surface is pre-patterned by a photo-lithographic process (see column 5, lines 23-28).

Regarding Claims 31, Lehmann and Ashmead both teach that the holes or channels can be coated with a catalyst (see Lehmann column 2, lines 34-42 and Ashmead column 7, lines 53-56)

Regarding Claim 35, Lehmann teaches a method where the etched surface can be pre-patterned by photolithography (see Col 6, Lines 34 to 60). Lehmann further teaches that the surface of the pores can be enlarged and the pore diameters maybe increased by increasing current density (see Col 2, Lines 6 to 67).

Claim 30 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lehmann (WO 99/061147) (referred to herein as the US equivalent patent Lehmann(US Patent 6,887,437) and Lin et al(US Patent 6,207,132) and Ashmead(US Patent 5,534,328), as applied to Claim 25, and in further view of Marsh (US Patent 6,281,161).

As applied to Claim 25, Lehmann, Lin, and Ashmead teach a method for fabrication of a catalyst body comprising:



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- (1) depositing a thin metallic layer on one side of the catalyst body which has a high hydrogen permeability;
- (2) etching a substrate silicon wafer to produce holes extending through the wafer;
- (3) depositing a catalytic active material at the inner walls of the etched pores which can include platinum;
- (4) stacking of the equally processed wafers using a pre-defined alignment structure.
- (5) combining reactor units and aligning them oppositely to each other in a way that an "interdigit" structure is formed.

Lehmann, Lin, and Ashmead do not specifically teach a method where the inner walls of the etched pores are coated by a metallic layer serving as a support structure for the catalytic active material.

Metallic layers are well known in the art as adhesion layers to enhance the adhesion of catalytic metals to silicon substrates. Marsh teaches a method of making a catalyst comprising depositing a platinum layer onto a substrate where an adhesion layer which can be metals is formed over the substrate and the platinum layer is formed over the adhesion layer (see Col 2, Lines 45 to 62). Marsh further teaches that an adhesion layer enhances adhesion of the platinum-comprising layer to the substrate due to the difficulties of adhering platinum directly to silicon (see Col 2, Lines 45 to 56). It would have been obvious to one of ordinary skill in the art at the time of the invention to perform the method as taught by Lehmann, Lin, and Ashmead with a step for

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providing a metallic layer supporting the catalytic active metal to improve the adhesion of a platinum catalytic material to a silicon substrate.

Claim 34 is rejected under 35 U.S.C. 103(a) as being unpatentable over Morse et al(US Patent Application Publication 2003/0103878) and further in view of Lehmann (WO 99/061147) (referred to herein as the US equivalent patent Lehmann(US Patent 6,887,437).

Morse teaches a fuel cell system comprising a fuel cell and a microreactor for generation of fuel from liquid sources through steam reforming processes (see Para 005 to 0011). Morse further teaches a fuel cell system where catalyst is imbedded in a porous membrane (see Para 0024). Morse further teaches that heat maybe be coupled between the catalytic microreactor elements(microchannel and porous membrane) and a fuel cell, thereby reducing the power requirement to heat the fuel cell and make a very efficient power source (see Para 0037).

Morse does not specifically teach a fuel cell system where the microreactor comprises a catalyst body having cavities extending perpendicularly to the surface of the body.

Lehmann teaches a reactor comprising a housing and a porous silicon substrate that is used as a catalyst support. The silicon substrate comprises a first and second main surface and holes extending perpendicularly and traversing from the first main surface to the second main surface (see Col 1, lines 40-53). Lehmann teaches that the

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housing including feeds where reactants which pass via the first feed into the space then pass through the pores to the second feed (see Col 4, Lines 35-41 and Figure 1).

Lehmann further teaches that advantageous applications of the reactor arrangement include all catalytic reactions (see Col 2, Lines 43-45). Lehmann further teaches that reactor comprising a silicon wafer with pores is capable of operating at higher catalyst temperatures (see Col 1, Lines 58 to 67). Morse further teaches that the steam reforming reactions occur at high temperatures (see Para 0024).

A simple substitution of one known element for another to yield predictable results supports a finding of prima facie obviousness. It would have been obvious to one of ordinary skill in the art at the time of the invention to substitute the microreactor in the fuel cell system as taught by Morse with the microreactor as taught by Lehmann, because both Morse and Lehmann teach microreactors that are suitable for high temperature reactions.

### ***Response to Arguments***

Applicant's arguments filed 3/20/2009 have been fully considered but they are not persuasive.

In response to applicant's argument that the amended title and preamble of the claims focusing on a catalyst body in a hydrogen reforming reactor do not conflict with the prior art, a recitation of the intended use of the claimed invention must result in a structural difference between the claimed invention and the prior art in order to

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patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim.

Here, Lehmann teaches a reactor comprising a housing and a porous silicon substrate that is used as a catalyst support. The silicon substrate comprises a first and second main surface and holes extending perpendicularly and traversing from the first main surface to the second main surface (see Lehmann US Patent 6,887,437, column 1, lines 40-53). Although the instant claim contains the phrase "hydrogen reforming reactor" in the preamble, it is only a statement of intended use without disclosing any structural difference with the reactor taught by Lehmann. The reactor taught by Lehmann is capable of performing the intended use of hydrogen reforming.

In response to applicant's argument that the fabrication method is not part of the invention, the argument is not relevant. Lehmann and Ashmead are relied upon in the rejections as teaching products as well as the method of making the products. The product taught by Lehmann is structurally identical to the present invention **as claimed** as laid out in the rejection under 35 USC § 102. The product taught by Lehmann and Ashmead is structurally identical to the present invention **as claimed** as laid out in the rejection under 35 USC § 103.

### ***Conclusion***

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP

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§ 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MICHAEL FORREST whose telephone number is (571)270-5833. The examiner can normally be reached on Monday - Thursday, 9:00am - 5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Curtis Mayes can be reached on (571)272-1234. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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